Acid Base strength Ka and pKa, pH and pKa

**1.** Hypochlorous acid has a p*K*a of 7.53. Another weak acid, hydrofluoric acid, HF, has a p*K*a of 3.17.

A 0.100 mol L–1 solution of each acid was prepared by dissolving it in water.

Compare the pHs of these two solutions. *No calculations are necessary.*

**2.** Aqueous methylamine, CH3NH2, solution has a pH of 11.8. Show by calculation that the concentration of

this solution is 0.0912 mol L–1.

**3.** 1 mol of each of the following substances was placed in separate flasks, and water was added to these

flasks to give a total volume of 1 L for each solution.

In the box below, rank these solutions in order of **increasing** pH. Justify your choice and include equations

where appropriate.

CH3NH3Cl

CH3NH2

HCl

**4.** What is the pH of 20.0 mL of 0.0896 mol L–1 ethanoic acid

p*K*a (CH3COOH) = 4.76

**5.** Calculate the concentration of methanoic acid solution with a pH of 2.78.

p*K*a (HCOOH) = 3.74

**6.** Calculate the pH of 0.150 mol L–1 aqueous ammonia, NH3.

p*K*a (NH4+) = 9.24

**7.** A solution prepared by d­issolving hydrogen fluoride in water has a pH of 2.34. Calculate the

concentration of the hydrogen fluoride in the solution.

p*K*a (HF) = 3.17

**8.** Glycolic acid, HOCH2COOH, is a monoprotic acid used in various skin-care products, and can be represented as **HG**. Glycolic acid has a p*K*a value of 3.83.

(a) Write an equation for the reaction of glycolic acid, HG, with water.

(b) Write the *K*a expression for glycolic acid, HG.

(c) Calculate the pH of a 0.675 mol L–1 solution of glycolic acid, HG.

**9.** An aqueous solution of ammonium chloride (NH4Cl) has a pH of 4.66. Calculate the concentration of the NH4Cl solution. p*K*a(NH4+) = 9.24 *K*a = 5.75 × 10 –10

**10.** Ethanoic acid, CH3COOH, is a common organic acid.

p*K*a (CH3COOH) = 4.76 *K*a = 1.74 × 10–5

(i) Write an equation for the reaction of ethanoic acid with water.

(ii) Write the *K*a expression for ethanoic acid.

(iii) Calculate the pH of a 0.0500 mol L–1 ethanoic acid solution.

**11.** The pH of the hydrazoic acid (HN3) is 2.6. Calculate the concentration of the HN3 solution.

p*K*a(HN3) = 4.72

**12.** When bromine is added to water, it forms hypobromous acid (HOBr), a weak acid.

(i) Write the *K*a expression for hypobromous acid.

(ii) Calculate the pH of a 0.0525 mol L–1 hypobromous acid solution. p*K*a(HOBr) = 8.62

**13.** The pH of the solution in the stomach of a patient in hospital is 2.50. As a treatment, the patient is given a small volume of sodium citrate (Na3Cit) solution. Citric acid, H3Cit, is a triprotic acid.

(a) (i) Would the pH of a solution of sodium citrate be less than, equal to or greater than 7?

*A calculation is not required.*

(ii)Explain your choice, **including an appropriate equation** in your answer.

**14.** An aqueous ammonia solution has a pH of 10 and when phenolphthalein indicator is added it turns pink. Solid ammonium chloride is added to this solution and the solution turns colourless due to a decrease in pH.

By considering the equilibrium systems, discuss why the pH of the solution decreased. **Include a relevant equation** in your answer.

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